



# JP11133075A2: DEVICE AND METHOD FOR MEASURING ELECTRICAL CHARACTERISTICS

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**Abstract:** **Problem to be solved:** To prevent the erroneous judgment of a measurement result due to the contact resistance between an electrode pad and a probe for contact in the measurement of electrical characteristics of a semiconductor device in a wafer state. **Solution:** Probes 3-1-10-2 for contact are brought into contact with electrode pads 3-10 of a semiconductor device in a wafer state. At this time, two probes for contact are brought into contact with one electrode pad. One of the two probes is fixed to ground potential and a proper voltage is applied to the other, thus obtaining contact resistance. When the value of the contact resistance is not proper, the measurement of electrical characteristics is stopped. On the other hand, when the value is proper, the measurement is continued. Also, since the value of the contact resistance can be obtained, an erroneous judgment due to contact resistance can be prevented by adding the amount of decrease of a measurement current to a current standard. Also, since two probes for contact are in contact with one electrode pad, an erroneous judgment can be prevented if one probe is normally in contact even if the contact resistance of the other abruptly increases.  
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Other Abstract Info: none

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## DETAILED DESCRIPTION

## [Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] Especially this invention relates to the equipment which prevents the incorrect judging by the influence of the contact resistance of the probe for a contact at the time of the electrical property of the semiconductor equipment of the \*\*\*\*\* status, and an electrode pad about the electrical property measuring device and measuring methods of an electronic instrument, such as semiconductor equipment.

[0002]

[Description of the Prior Art] Conventionally, as a measuring method of the incorrect judging prevention by the influence of the contact resistance of the probe for a contact at the time of electrical property measurement of this kind of semiconductor equipment, and an electrode pad, the incorrect judging by the influence of contact resistance is prevented by the technique which is shown, for example in No. 39025 [ Showa 58 to ].

[0003] The drawing 2 -1 of drawing 2 - the view 2 -5 show the well-known example of No. 39025 [ Showa 58 to ].

[0004] The sign of drawing 2 -1-5 of the conventional example and the well-known example of No. 39025 [ Showa 58 to ] is explained to below.

[0005] the drawing 2 -1 - the view 2 -5 -- setting -- 1 -- semiconductor equipment (LSI) and 2 -- a probe card and 11 -- for an electrode pad and 14, as for a resistance layer and 16, an insulating layer and 15 are [ \*\*\*\*\* (LSI) and 12 / the element for contact resistance authentication, and 13 / the probe for a contact and 17 ] metal layers

[0006] Drawing 2 -1 is the semiconductor equipment of the \*\*\*\*\* status, and having some elements for contact resistance authentication in the field of \*\*\*\*\* is shown. This element for contact resistance authentication ( drawing 2 -3) can form an electrode 13 in a \*\*\*\*\* front face, and can measure resistance of the resistance layer 15 connected to the electrode 13 by connecting the probe for a contact 16 to this electrode. If it is good, the resistance of this resistance layer 15 can be measured, the quality of the contact status of the contact probe 16 can be judged from the measured value, measurement is continued, and if it is no, it is the measuring method which suspends measurement.

[0007] Moreover, as shown in drawing 2 -5, the metal layer 17 can be formed on \*\*\*\*\* , and the quality of the contact status of the contact probe 16 can also be judged from the measured value of this resistance layer.

[0008]

[Problem(s) to be Solved by the Invention] The 1st trouble is that some semiconductor equipments in \*\*\*\*\* serve as the exclusive element for contact resistance authentication. Since the semiconductor equipment only for contact resistance authentication is arranged, the number of the semiconductor equipments which should originally be manufactured will decrease on \*\*\*\*\* . Moreover, since two kinds of layouts exist on \*\*\*\*\* , a manufacture process becomes complicated.

[0009] The semiconductor equipment which should originally manufacture the ground on \*\*\*\*\* is because the element only for contact resistance authentication of different some is made. Although many elements only for contact resistance authentication must be arranged in order to measure contact resistance with a sufficient precision in a \*\*\*\*\* side when arranging the element only for contact resistance authentication on \*\*\*\*\* , the semiconductor equipment which should be arranged so much on \*\*\*\*\* will decrease, the yield will fall, and a cost will go up. It becomes remarkable so that especially the area of semiconductor equipment is large.

[0010] Moreover, in order to form two layouts different on \*\*\*\*\* , in the exposure process which carries out patterning of the photoresist, a throughput becomes bad. Although this is exposed with the light (G string etc.) which penetrated the reticle when carrying out patterning of the photoresist, apart from the semiconductor equipment pattern which should originally be formed in the reticle, the pattern for the elements for contact resistance authentication is needed on a reticle. Since the limit on an aligner is prepared in the size of a reticle, the field of the reticle which can use only the part of the pattern for the elements for contact resistance authentication for semiconductor equipment will become narrow. Since the whole wafer will be exposed in a narrow exposure field, it is necessary to expose by winding many more and \*\*\*\*ing, and, also conventionally, a result and a throughput become bad.

[0011] Although the 2nd trouble forms some elements only for contact resistance authentication in a \*\*\*\*\* side, it is that there is a case where the contact status at the time of measurement of actual semiconductor equipment is not being reproduced by this contact resistance measuring method.

[0012] As for the ground, the contact resistance of the electrode pad of semiconductor equipment and the probe for a contact changes delicately in a \*\*\*\*\* side. Moreover, change of an electrode pad surface state or the status of the needle point of the probe for a contact is also affected at contact resistance. For this reason, if contact resistance is not measured on actual semiconductor equipment, a misjudgment law may be carried out at the time of measurement.

[0013] That is, on the element for contact resistance authentication, even if it is satisfactory to contact resistance, when measuring actual semiconductor equipment, contact resistance may become high and may carry out a misjudgment law under the influence.

[0014] The purpose of the [purpose of invention] this invention aims at preventing the contact resistance with the probe for a contact attached in the electrode pad and probe card of semiconductor equipment becoming large, and carrying out a

misjudgment law under the influence of contact resistance at the time of electrical property measurement in the electrical property measurement examination of an electronic instrument, especially the semiconductor equipment in the \*\*\*\*\* status.

[0015]

[Means for Solving the Problem] The electrical property measuring device of the semiconductor equipment of this invention can contact at a time two probes for a contact which have a touch area of the same grade as the former to one electrode pad, can measure a contact resistance value, can judge whether the electrical property measurement status is normal, and can prevent the incorrect judging by the influence of contact resistance.

[0016] Moreover, from the calculated contact resistance value, current decrement rationalization can be carried out, or influence by increase of sudden contact resistance can be lessened by the thing which depends measurement specification on contact resistance and which is made to contact two at a time, and the incorrect judging at the time of electrical property measurement can be prevented.

[0017] [Operation] It contacts at a time two probes for a contact which have a touch area of the same grade as the former to one electrode pad, and a contact resistance value is known by passing a current between these two probes for a contact.

[0018] If this contact resistance value is not a proper value, measurement will be interrupted and the yield fall by incorrect judging will be prevented.

[0019] If it is appropriate measured value, electrical property measurement of semiconductor equipment will be continued.

[0020] Moreover, if large so that the measured contact resistance value may affect it to the measurement current of an electrical property measurement examination, measurement specification rationalization of an electrical property measurement examination can be performed.

[0021] Moreover, it can contact at a time two probes for a contact which have a touch area of the same grade as the former to one electrode pad, an amperometry can be performed by each two, and influence of increase of sudden contact resistance can be lessened by adding two measured value. Since this is the same as that of having carried out parallel connection of the resistance, it can decrease the influence of contact resistance.

[0022] Moreover, if one more touches normally even if sudden resistance is attached to one probe for a contact, the influence is because it is few.

[0023] Below, further, in order to solve this technical problem although it is making for this invention to prevent an incorrect judging of the measurement result by the contact resistance of an electrode pad and the probe for a contact in electrical property measurement of the semiconductor equipment of the \*\*\*\*\* status into the technical problem if an operation of this invention is explained, this invention contacts the probe for a contact 3-1 to 10-2 to the electrode pads 3-10 of the semiconductor equipment of the \*\*\*\*\* status, as shown in drawing 1. At this time, two probes for a contact are contacted to one electrode pad. Contact resistance can be found in these two one of the two by \*\*\*\*\*ing the suitable voltage for fixation and another side to grounding potential. If this contact resistance value is not a suitable value, electrical property measurement will be stopped, and if it is a suitable value, electrical property measurement will be continued.

[0024] Moreover, since a contact resistance value can be found, the incorrect judging by contact resistance is prevented by seasoning current specification with the decrement of the measurement current by this contact resistance.

[0025] Moreover, suddenly, since two probes for a contact are contacted to one electrode pad, one side can prevent an incorrect judging, if the contact with normal another side is carried out even if contact resistance becomes high.

[0026]

[Embodiments of the Invention]

[Gestalt of the 1st operation]

The gestalt of operation of the 1st of [an explanation of a configuration], next this invention is explained in detail with reference to a drawing.

[0027] The drawing 1 -1 of drawing 1 and 1-2 are drawings which are performing the electrical property examination of the semiconductor equipment of the \*\*\*\*\* status. Drawing 1 -1 is a plan. Drawing 1 -2 is a side elevation.

[0028] As shown in drawing, the probe for a contact 3-1, 3-2, 4-1, 4-2, 5-1, 5-2, 6-1, 6-2, 7-1, 7-2, 8-1, 8-2, 9-1, 9-2, 10-1, and 10-2 are fixed to a probe card 2. The probe for a contact is connected to LSI circuit tester's input/output terminal which is not illustrated through a probe card 2, respectively and power, and grounding potential. The probe for a contact touches the electrode pads 3-10 which the semiconductor equipment 1 has.

[0029] However, two probes for a contact which have a touch area of the same grade as the former to one electrode pad touch. Each probe is fixed independently to a probe card, respectively so that voltage impression, current impression, an amplitude measurement, and an amperometry may be possible, and the probe for a contact is connected to LSI circuit tester which is not illustrated.

[0030] Explanation of operation is given for a [of operation explanation] output current examination for an example in drawing 1 -1 and the drawing 1 -2.

[0031] In addition, if it gets poisoned by explanation, it explains supposing the semiconductor equipment with 10 one one three three input terminals 3, 4, 5, and output terminals 6, 7, 8, and power-terminal 9 and an earth terminal.

[0032] The probe for a contact 3-1, 3-2, 4-1, 4-2, 5-1, and 5-2 touch the electrode pads 3-5 of an input terminal. The probe for a contact 6-1, 6-2, 7-1, 7-2, 8-1, and 8-2 <TXF FR=0001 HE=250 WI=080 LX=0200 LY=0300> touch the electrode pads 6-8 of an output terminal.

[0033] The probe for a contact 9-1 and 9-2 contact the electrode pad 9 of a power terminal, and the probe for a contact 10-1 and 10-2 touch the GND pad 10.

[0034] All the probes for a contact are independence and are connected to LSI circuit tester which is not illustrated so that voltage current impression and a voltage amperometry may become possible every probe.

[0035] An output current examination is carried out to an explanation of operation at an example, and it explains.

[0036] The flow chart of an output current examination of operation is shown in drawing 3.

[0037] When starting an output current examination, the probe for a contact 6-2 which touches the output pads 6-8 first, 7-2, and 8-2 are fixed to grounding potential. The suitable voltage Vn is impressed to the probe for a contact 6-1 in contact with the output pads 6-8, 7-1, and 8-1. The current which flows from the probe for a contact 6-1 at this time to 6-2, the current

which flows from the probe for a contact 7-1 to 7-2, and the current which flows from the probe for a contact 8-1 to 8-2 are measured, respectively ( $I_n$ ).

[0038] Next, contact resistance  $R_n$  can be calculated from the current  $I_n$  measured with the voltage  $V_n$  impressed to the probe for a contact 6-1, 7-1, and 8-1.

[0039] If contact resistance  $R_n$  is calculated, in order that this contact resistance may judge whether it is an appropriate value, a specification value will be established, the specification is exceeded, if like, it will judge that the measurement status is not proper and measurement of an electrical property will be interrupted.

[0040] When contact resistance  $R_n$  is lower than a specification value, electrical property examination measurement of semiconductor equipment is continued. The output current decrement by contact resistance  $R_n$  is added to output current specification limit, and suitable output current specification limit is set up.

[0041] A quality judging of a usual output current examination is performed in this output current specification limit.

[0042] [Gestalt of the 2nd operation]

The gestalt of operation of the 2nd of [an explanation of a configuration], next this invention is explained.

[0043] The 2nd configuration of the gestalt of operation is the same as the 1st configuration of the gestalt of operation.

[0044] A [of operation explanation] output current examination is explained for an example. Reference of the drawing 1 -1 of drawing 1, 1-2, and the flow chart of drawing 4 connects the probe for a contact 6-1 which touches the output pads 6-8 first, 6-2, 7-1, 7-2, 8-1, and 8-2 to the ammeter of LSI circuit tester which is not illustrating, respectively. Both the probe for a contact 10-1 in contact with the GND pad 10 and 10-2 are connected to grounding potential. The probe for a contact 9-1 in contact with the power pad 9 and 9-2 are connected to power potential.

[0045] When starting an output current examination, the probe for a contact 6-2 which touches the output pads 6-8 first, 7-2, and 8-2 are fixed to grounding potential. The suitable voltage  $V_n$  for the probe for a contact 6-1 which touches the output pads 6-8 similarly, 7-1, and 8-1 is impressed. The current which flows from the probe for a contact 6-1 at this time to 6-2, the current which flows from the probe for a contact 7-1 to 7-2, and the current which flows from the probe for a contact 8-1 to 8-2 are measured, respectively ( $I_n$ ).

[0046] Next, contact resistance  $R_n$  can be calculated from the current  $I_n$  measured with the voltage  $V_n$  impressed to the probe for a contact 6-1, 7-1, and 8-1.

[0047] If contact resistance  $R_n$  is calculated, in order that this contact resistance may judge in an appropriate value, a specification value will be established, the specification is exceeded, if like, it will judge that the measurement status is not proper and measurement of an electrical property will be interrupted.

[0048] The probe for a contact 3-2 in contact with the input pads 3, 4, and 5, 4-2, and 5-2 are made an opening, and it connects with LSI circuit tester which specifies the probe for a contact 3-1, 4-1, and 5-1 to be input pins, and is not illustrating them.

[0049] And operation of an output current examination measures a current, respectively in the probe for a contact 6-1, 6-2, 7-1, 7-2, 8-1, and 8-2. Each current value measured by two probes for a contact which have a touch area of the same grade as the former in contact with the same output pad is added.

[0050] That is, and it adds [ the current value of the probe for a contact 6-1, and the current value of the probe for a contact 6-2 ] the current value of the probe for an addition contact 8-1, and the current value of the probe for a contact 8-2 for the current value of the probe for an addition and a contact 7-1, and the current value of the probe for a contact 7-2, a quality judging of an output current examination is performed as compared with

[0051] Thus, by adding each current value measured by two probes for a contact which have a touch area of the same grade as the former in contact with the same output pad, even if the contact resistance of an electrode pad and the probe for a contact is suddenly high, the influence can be made small, and an incorrect judging can be lessened.

[Gestalt of the 3rd operation]

[An explanation of a configuration]

If drawing 5 is referred to, each which is being fixed to the probe card to one electrode pad of semiconductor equipment will contact the forked probe for a contact which has a touch area of the same grade as the former.

[0052] Although the probe for a contact is connected to LSI circuit tester which is not illustrating independently, respectively with the gestalt of the 1st operation, it connects with LSI circuit tester which does not illustrate the forked probe for a contact currently fixed to the probe card to one electrode pad of semiconductor equipment with the gestalt of the 3rd operation.

[0053] [an explanation of operation] -- the misjudgment according [ although the contact resistance of a probe for a contact and an electrode pad which were explained with the gestalt of the 1st operation cannot be measured if it is made this appearance, can simplify a complicated measurement procedure, and ] to the increase in sudden contact resistance -- a law can be decreased The operation itself is still the conventional measuring method.

[0054] In addition, this invention is applicable to all the electronic instruments that it cannot restrict [ electronic instruments ] to this and can contact the probe for a contact to an electrode pad although each above-mentioned example explained semiconductor equipment.

[0055]

[Effect of the Invention] It can judge whether in electrical property measurement of the semiconductor equipment of the \*\*\*\*\* status, the 1st effect can calculate the contact resistance value of an electrode pad and the probe for a contact, and the thing with the good measurement status and fault has it with the value.

[0056] It is asked for contact resistance by the ground contacting two probes for a contact to one electrode pad of semiconductor equipment, and passing a current between these two probes for a contact. If this contact resistance value is suitable, electrical property measurement of semiconductor equipment will be continued, if unusually high, electrical property measurement of semiconductor equipment will be suspended, and occurrence prevention of the incorrect judging by contact resistance is attained.

[0057] In electrical property measurement of the semiconductor equipment of the \*\*\*\*\* status, the 2nd effect can calculate the contact resistance value of an electrode pad and the probe for a contact, and the occurrence prevention of the incorrect judging by the influence of contact resistance of it is attained by rationalizing the current decrement measurement specification by the contact resistance value.

[0058] A contact resistance value is calculated by the ground contacting two probes for a contact to one electrode pad of semiconductor equipment, and passing a current between these two probes for a contact. Occurrence prevention of the incorrect judging by the influence of contact resistance is attained by calculating the current decrement by this contact resistance value, and rationalizing measurement specification.

[0059] In electrical property measurement of the semiconductor equipment of the \*\*\*\*\* status, the 3rd effect is contacting two probes for a contact which have a touch area of the same grade as the former to one electrode pad, and measuring, and can decrease the incorrect judging by the increase in sudden contact resistance.

[0060] The ground performs an amperometry by each two probes for a contact which have a touch area of the same grade as the former, and even if the contact resistance of one probe for a contact increases suddenly by adding each measured value, it can decrease the influence. Since this is the same as that of having carried out parallel connection of the resistance, it turns out that it can decrease the influence of contact resistance.

[0061] Moreover, when one probe for a contact has increase of sudden contact resistance, if another side is carrying out the normal contact, the influence can be lessened, and it turns out that the incorrect judging by electrical property examination of semiconductor equipment can be prevented.

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[Translation done.]